UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/516,300	12/09/2004	Gino Palumbo	BROO300	5590

23364 7590 10/07/2008

BACON & THOMAS, PLLC
625 SLATERS LANE
FOURTH FLOOR
ALEXANDRIA, VA 22314-1176

EXAMINER	
LEADER, WILLIAM T	
ART UNIT	PAPER NUMBER
1795	
MAIL DATE	DELIVERY MODE
10/07/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/516,300	PALUMBO ET AL.	
	Examiner	Art Unit	
	WILLIAM T. LEADER	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :1/6/05; 11/23/05; 12/5/07; 4/22/08; 7/17/08.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-33 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 has been amended to recite an agitation rate in the range of 0.01-10 liter per minute per cm^2. Basis for this newly recited range in the specification as filed is not apparent. New claims 31 and 33 recite an agitation rate in the range of 0.0001 to 10 liter per min and per cm^2. Basis for this range in the specification as filed is not apparent.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 17 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 17 uses wording similar to

traditional Markush group language. However, "consisting of" after "group" is missing. Consequently, it is not clear if the group is closed or open to the inclusion of other constituents. See MPEP 2173.05(h).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1-12, 15, 17, 27-31 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erb et al (US 5,433,797) in view of the Lowenheim text

Electroplating and additionally in view of Biberbach et al (US 3,929,595) and Gonzalez et al (6,743,346).

8. The Erb et al patent is directed to the electrodeposition of metallic materials in nanocrystalline form. Erb et al disclose that nanocrystalline nickel having a grain size of less than 11 nanometers, and selected pure metals, binary, ternary and quaternary alloys thereof having a grain size of less than about 100 nanometers may be produced (column 1, lines 13-19). As shown in example 1, an aqueous electrolyte containing ions of nickel to be deposited was provided. This corresponds to step (a) recited in claim 1. In example 7, Erb et al disclose that the electrolyte was stirred continuously at 0-500 rpm. This would have provided some amount of agitation.

9. Claims 1 and 33 differ from the process of Erb et al by reciting a deposition rate of at least 0.05 mm/h and agitating the electrolyte at an agitation rate of 0.01 to 10 liter per minute and per cm^2. Erb is silent as to deposition rate and agitation rate. The Lowenheim text *Electroplating* discusses the importance of mass transport in an electrodeposition process. As metal is deposited upon a cathode, the solution in its immediate neighborhood is depleted in metal ions. If plating is to continue, these ions must be replenished. This may be accomplished by convention which involves the movement of substantial quantities of the solution relative to the electrodes. The electrodes may move, the solution may move, or both. The cathodes

may be agitated by commercially available rod agitators, the solution may be stirred by propellers, or it may be pumped through heat exchangers for both temperature control and agitation. See page 139.

10. The Biberbach et al patent is directed to the electrodeposition of gold with a high rate of deposition. Biberbach et al disclose that gold may be deposited at a rate of 1 μm (0.001 mm) in 0.75 to 1.5 minutes (0.04 to 0.08 mm/hr) depending on the agitation of the bath. Thus, Biberbach recognizes that agitation affects the rate of deposition. In example 4, the articles being plated were provided with a motion of 4 cm/sec. The deposition of a coating 8 μm thick took place in 10 minutes (0.048 mm/hr). In example 5, the composition and temperature were the same as in example 4, but the article motion was 25 cm/sec. It took 48 seconds to deposit a coating 1 μm thick (0.075 mm/hr). These examples show the effect of increased agitation on deposition rate.

11. The Gonzalez et al patent is directed to the electrochemical deposition of palladium or its alloys. Gonzalez et al teach that the process can be applied where it is sought to work at the maximum deposition rate. To obtain high productivities, the baths have to operate at the highest possible current density and a high temperature, and a high agitation rate is often necessary (column 6, lines 48-54). In example 2, a palladium-nickel alloy is deposited. Agitation was vigorous to very

vigorous. The deposition rate at a current density of 28 A/dm2 was 1 μm in 10 seconds (0.36 mm/h).

12. The prior art or record is indicative of the level of skill of one of ordinary skill in the art. It would have been obvious at the time the invention was made to have agitated the bath in the process of Erb because relative motion between the solution and article being plated, which serves at the cathode electrode, improves mass transport and replenishment of metal ions in the vicinity of the cathode as taught by Lowenheim, and agitation provides increased deposition rates which result in increased process efficiency as shown by Biberbach et al and Gonzalez et al. Both Biberbach et al and Gonzalez et al disclose deposition rates which fall within the range recited in instant claim 1. As shown by the references, agitation is a result-effective variable. Choice of an appropriate amount of agitation would have been a matter of routine optimization.

13. Claim 27 is dependent on claim 1 and recites in paragraph (b) single or multiple pulses in a frequency range which includes 0 Hz, and an off time period range which includes 0 msec. These two limitations include non-pulsed direct current. Paragraph (c) recites an anodic time period range which includes 0 msec. This limitation also includes non-pulsed direct current. Paragraph (d) recites a duty cycle which includes 100%. This similarly includes non-pulsed direct current. Thus, claim 27 includes the use of straight direct current as well as pulsed current.

With respect to claim 27, Erb discloses the use of direct current or pulsed direct current (column 3, lines 53-54). The pulsed current may have a peak current density between about 0.1 and 3.0 A/cm2, an on time of about 0.1 to 5 milliseconds, and an off time of about 1 to about 500 milliseconds. See column 2, lines 62-68. These values fall within the ranges recited by applicant.

14. With respect to claim 28, Erb et al disclose that the electrolyte is maintained at a temperature of between about 15 to 75 °C. This range falls within the range recited in claim 28.

15. With respect to claims 2 and 3, as noted above, Erb discloses peak current densities falling within applicant's recited ranges.

16. With respect to claim 4, Erb discloses deposition of pure metals and alloys including many of those recited by applicant such as Co, Cr, Cu and Fe. See column 3, lines 3-13. With respect to claim 29 which is dependent on claim 4, Erb discloses that it is known to deposit nickel-phosphorus (column 2, lines 19-20).

17. With respect to claim 5, Erb teaches the use of periodic pulse reversal. The reverse pulse would have included an anodic time period (column 6, lines 34-37). Pulse parameters are result effective variables. Choice of appropriate parameters would have been a matter of routine optimization. With respect to claims 6 and 7, Erb disclose pulse plating parameters which provide a duty cycle and frequency within the ranges recited by applicant (column 2, lines 62-68 of Erb)

18. With respect to claim 8, Biberbach et al and Gonzalez et al disclose a deposition rate falling within the range recited.

19. With respect to claim 9, the amount of agitation would have been a matter of routine optimization.

20. With respect to claim 10, as noted above, Lowenheim teaches using a pump to provide agitation. With respect to claims 11 and 15, as noted above, Lowenheim discloses agitating the cathodes using a commercial rod agitator. With respect to claim 12, the amount of agitation is a matter of routine optimization.

21. With respect to claim 17, Erb discloses the inclusion of a stress relieving agent such as saccharin, coumarin, sodium lauryl sulfate and thiourea. See column 4, lines 51-56.

22. With respect to claim 30, Erb discloses that the formation of an alloy of Fe with Ni is known (column 2, lines 18-19).

23. With respect to claim 31, as noted above, Erb discloses the use of cathodic current pulses.

24. Claims 16, 18-25 and 32 rejected under 35 U.S.C. 103(a) as being unpatentable over Erb et al (US 5,433,797) in view of the Lowenheim text *Electroplating* and additionally in view of Biberbach et al (US 3,929,595) and

Gonzalez et al (6,743,346) as applied to claims 1-12, 15, 17, 27-31 and 33 above, and further in view of the admitted prior art.

25. The prior art is that found in applicant's specification under the heading "Description of prior art/background of the invention".

26. With respect to claim 16, the admitted prior art includes Icxi patent 2,961,395 which discloses using a hand-manipulated applicator which serves as an anode and has a wick (absorbent separator) containing the electrolyte. It would have been obvious to have utilized a hand-manipulated applicator as taught by Icxi to have carried out the process suggested by Erb because an article could be plated without the necessity of immersing it into a plating tank.

27. With respect to claim 18, the admitted prior art includes Mori patent 5,496,463 which discloses composite electroplating in which solid particles are introduced in fine form into the electrolyte. It would have been obvious to have included particulate material in the process of Erb because the properties of the deposit would have been improved. With respect to claims 19-23, the amount and size of particulate material are result-effective variables which affect the characteristics of the coating. Choice of an amount of particulates to have included in the deposit would have been a matter of routine optimization.

28. With respect to the product of claims 24, 25 and 32. The admitted prior art includes the recognition that micromechanical systems (MEMS) have overall

dimensions ranging from 1 to 1000 μm. As noted above, Erb discloses the formation of deposits with a grain size of less than 11 nanometers. In example 6, the grain size was 6 nm. Formation of a micromechanical device having the grain size produced by the process of Erb in a size taught by the admitted prior art would have resulted in the ratio between maximum dimension of the device and grain size recited as recited by applicant.

29. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erb et al (US 5,433,797) in view of the Lowenheim text Electroplating and additionally in view of Biberbach et al (US 3,929,595) and Gonzalez et al (6,743,346) as applied to claims 1-12, 15, 17, 27-31 and 33 above, and further in view of Uzoh et al (US 7,378,004).

30. Claim 13 recites that the relative motion is achieved by rotation of anode and cathode relative to each other. The Uzoh et al patent is directed to an electrodeposition process. Uzoh teaches that the substrate holder may be rotated to aid electrolyte agitation and enhance mass transfer. See column 1, lines 61-64. It would have been obvious at the time the invention was made to have rotated the substrate in the process of Erb et al to have provided agitation. Choice of the amount of agitation would have been a matter of routine optimization.

31. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Erb et al (US 5,433,797) in view of the Lowenheim text *Electroplating* and additionally in view of Biberbach et al (US 3,929,595), Gonzalez et al (6,743,346) and the admitted prior art as applied to claims 16, 18-25 and 32 above, and further of Hutkin (US 4,088,544).

32. Claim 26 additionally specifies that the component has an equiaxed micro structure. The Hutkin is directed to a process for making copper foil by electroplating. The copper deposited during the electroplating can be controlled so as to favor the formation of either columnar crystals or equiaxed crystals (column 5, lines 14-18). It would have been obvious to have chosen plating parameters to have formed an equiaxed deposit in the process of Erb et al as shown by Hutkin depending on the desired properties of the component being formed.

33. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The Scruggs et al patent (US 5,389,226) is directed to the deposition of amorphous and microcrystalline coatings. It is recognized that microcrystalline (including nanocrystalline) materials have very small grains, but have excellent erosion and corrosion resistance (column 1, lines 31-34). Scruggs et al teach that the deposition rate is normally preferred to be as great as possible, since the process efficiency is directly related to deposition rate (column 5, lines 34-

36). Biswas et al (US 4,592,932) discloses that in an electroplating process agitation of the bath solution increases the movement of the ions and hence increases the deposition rate (column 6, line 28).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to WILLIAM T. LEADER whose telephone number is (571) 272-1245. The examiner can normally be reached on Mondays-Thursdays and alternate Fridays, 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Susy Tsang-Foster can be reached on 571-272-1293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/William Leader/
September 30, 2008

/SUSY N TSANG-FOSTER/
Supervisory Patent Examiner, Art Unit 1795